Association for Information Systems
AIS Electronic Library (AISeL)

PACIS 1995 Proceedings

Pacific Asia Conference on Information Systems (PACIS)

December 1995

Issues of Accounting Information System for the Year 2000

Chuk Yan
Griffith University

Pak Auyeung
Griffith University

ISSUES OF ACCOUNTING INFORMATION SYSTEM FOR THE YEAR 2000

Chuk Yau
School of Computing & I.T.
Griffith University

Pak K. Auyeung
School of Accounting & Finance
Griffith University

There is no doubt that the "marriage" of the accounting and computing specialisations provides a critical resource for all businesses. However, there are problems arising from the "marriage", which are presently solved through compromise rather than rationality and optimisation. In order to strengthen the development of AIS, it is necessary to formulate a coherent conceptual framework as a fusion of the interrelated accounting and computing objectives and concepts. The changeover to the fusion concept requires the short and long term efforts of accountants, computing professionals, and professional and educational institutions in reorienting accounting education and in developing a professional AIS standard and more sophisticated information architecture.

1 Problems of Accounting Information Systems

As the lifeblood of any competitive businesses, accounting information is a critical resource for all enterprises. The concept of accounting information systems (AIS) is quite well established and numerous commercial packages as well as tailor-made systems have been developed. However, the business world is beset by accounting systems that have varying levels of efficiency and excessive costs for such information. It has been commonly believed that to date most problems of AIS have resulted from the lack of comprehensive planning to revitalise their information systems in light of: the progress that has been made in information technologies; software quality; sophisticated system design and development; employment of quantitative models; identification of information needs; and proper systems auditing. The aims of this paper are to propose a coherent conceptual framework for improving the overall AIS environment and to recommend directions for achieving the conceptual model. Before these issues are addressed, it is useful to understand the nature of the existing major problems of AIS.

1.1 A Cultural Problem

Since the double-entry bookkeeping concept was introduced by Luca Pacioli [Taylor 1956] five hundred years ago, accountants have used the framework of double-entry bookkeeping as the basic tool for gathering and aggregating accounting data. In order to verify the correctness of data entries, a trial balance is needed before an income statement and balance sheet can be produced. Some heuristic rules also are introduced to help identify data entry mistakes if a trial balance has problems. This procedure has been accepted as a traditionally necessary accounting practice.

In 1980, a computer software development company, Dastra Limited, introduced a new version of its accounting package. In addition to a number of improvements in report generation, the new version was claimed as a revolutionary product which purposely eliminated the use of a trial balance. The reason for its omission was that the data entries were validated by the computer to make sure that the credit and debit amounts of each transaction were equal before the data was actually posted. The company expected that the new version would bring a better image of being innovative to the company in the accounting software market. However, the sales figures reflected that the innovative concept was a failure as most, if not all, of the customers still preferred the old version because they wanted to preserve the traditional trial balance. As this situation to day remains unchanged, there is certainly a barrier between the technological development and the culture. Overcoming the cultural problems requires an effort from fundamental education and extensive efforts from different relevant parties.

1.2 User Requirement Problems

AIS has evolved from the general ledger machine to the setting which may be multi-media or distributed. There are two types of software, namely tailor made and "off the shelf", that are widely employed by different organisations. "Off the shelf" accounting software is a quick solution for most companies. An increasing number of "off the shelf" accounting software packages are available for different kinds of computers. Some accounting software packages offer sophisticated features, such as multi-companies and multi-currencies, to meet the requirements of different organisations. It is the belief that "off the shelf" software is a reasonable and cost effective solution for computerising accounting

systems. However, the adequacy of the "off the shelf" packages depends on the flexibility of the user requirements. User companies have started to accept the fact that "off the self" software would only meet between 65 and 85 percent of their requirements [MA Sept.1990]. For example, a company's finance director found shortcomings on the nominal ledger facilities in the accounting packages examined. He wanted to be able to have full accrual and prepayment facilities, which most packages could not provide. He was also unhappy with the way "off the shelf" packages did not have the ability to carry out detailed sorts of the client and supplier databases according to whatever ad hoc selection criteria might be required. Accepting "off the shelf" accounting software implies that users have to try to fit their requirements to the softwares' capabilities.

On the other hand, developing tailor made software may increase the functionalities to meet specific user requirements. The success of a tailor made AIS depends very much on the co-operation between the users and the developers. Close collaboration with the users lead to good systems analysis and design allowing software developers to gain an understanding of the user requirements. However, the acsychronous movement of the development life cycle and the change of information needs may cause unjustifiable investment to organisations.

1.3 A Problem of Technological Gaps

Accounting methods have been extended from simple mathematics to complicated models based on operations research, probability and econometrics [Kaplan 1984]. However, most automated accounting systems still employ extremely simplified models, such as the single product, deterministic EOQ formula, and simple NPV method (Horngren 1986). Although standard costing has been in use for almost fifty years [Batty,1970], very few accounting packages actually support it. In the past, the computational complexity was always the main reason that made sophisticated model impractical. This situation remains unchanged even though the power of computer and information technologies has been improved dramatically. Most of today's AIS, no matter they are "off the shelf" or "tailor made" packages, act as efficient book-keeping systems and financial report systems. Very few of these packages actually perform as sophisticated management and costing accounting systems. This problem may be due to the lack of a high degree of mutual understanding between accountants and computer specialists.

1.4 A "Marriage" Concept for AIS

The above problems are just some examples that are commonly found in real life situations. However, most problems can be characterised as conflicts in approach between computing and accounting. In fact, these two disciplines can be recognised as two important branches of knowledge. In the past five hundred years, accounting has become a well established area which comprises a number of specialisations, such as financial accounting, management accounting, cost accounting, taxation, and auditing. To become a general accountant or a specialist, one has to expend an extensive effort in learning and practising. Although computing is a much younger discipline than accounting, its rapid growth has accumulated so much contents that no one can master its principles without spending a significant amount of time and effort.

There are many successful computing applications which offer significant contributions to different areas of our society which include accounting. The development of AIS can be regarded as a co-operation work between accounting and computing people. In this paper, co-operation is described as a "marriage" between accounting and computing. Before "marriage", there is no doubt that putting these two specialisations together would improve the management of organisations [Pellman 1991]. However, after marriage, difficulties have been found in the processes of the development and management of AIS. Computing people are interested in the information processing logic without giving due attention to the accounting practices. This gives rise to the cultural problems as previously described . Although accounting and business computing professionals are expected to know both accounting and computing, the non-major knowledge gained from most undergraduate programmes is superficial. The lack of a good common background of accountants and computing people causes many problems too. In most successful cases, problems are solved by compromise between accountant's requirements and software development capabilities. However, there are some examples that companies were forced to revert to manual operation after suffering from undesirable problems which have been caused by an uncompromising "marriage".

Unlike other applications, such as production and sales, accounting is the most established discipline in the business world. With the statutory requirements, accounting practices have to comply with the institutional standards. Therefore computing people with no extensive accounting knowledge and experience may encounter difficulty in fully interpreting the accountants' express requirements and inferring other unstated needs. This paper intends to propose a framework which will optimise (not compromise) the strength of the two technologies.

2 A Conceptual Framework of Accounting Information Systems

Beyond all doubt, accounting information systems can be described as a human activity system. Basically, a "system" may be defined literally as "a complex or organised whole; an assemblage or combination of things or parts forming a complex or unitary whole" [Johnson et al, 1964]. To be more precise, AIS can be regarded as an integration of resources, techniques and practices which are used for accounting function. The basic components of AIS are: business operations which generate raw data; management which provide knowledge and requirements for transforming the data into meaningful information and utilising it for other business functions; information systems which include software and hardware; and development people.

2.1 The Mission

A generally accepted mission of AIS within an organisation is to perform the service function of transforming quantifiable financial data into useful information that efficiently and effectively aids management and outside users in making decisions about the allocation of scarce economic resources. Figure 1 shows the role of AIS within an organisation.

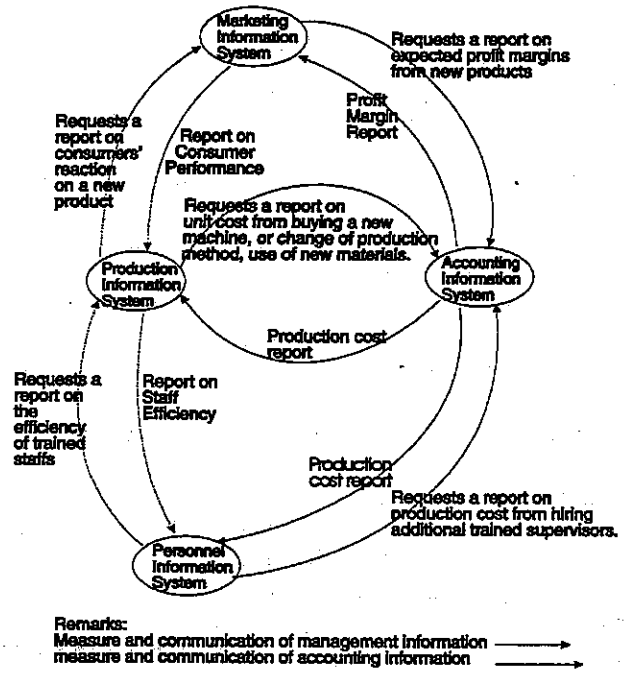

Figure 1: The Role of AIS

2.2 The Environment

AIS is actually one major component of a management information system (MIS). Whereas AIS accumulates, classifies, processes, analyses and communicates relevant financial information, MIS performs these functions for all types of information affecting a company's operations, such as marketing subsystem performing an analysis of customer product preferences, and production subsystem experimenting a new production method. The subsystems and activities which make up MIS show a degree of connectivity. Systems connectivity is commonly considered as a map for problem investigation. Normally, it can be presented in terms of information flows among activities and interaction among staff. A logical representation of systems connectivity may provide management with a better picture to locate some critical problems in the systems. Bottleneck of information flows is a common problem that can easily be found in the analysis of system connectivity. The relationships between AIS and other management functions are shown in Figure 2.

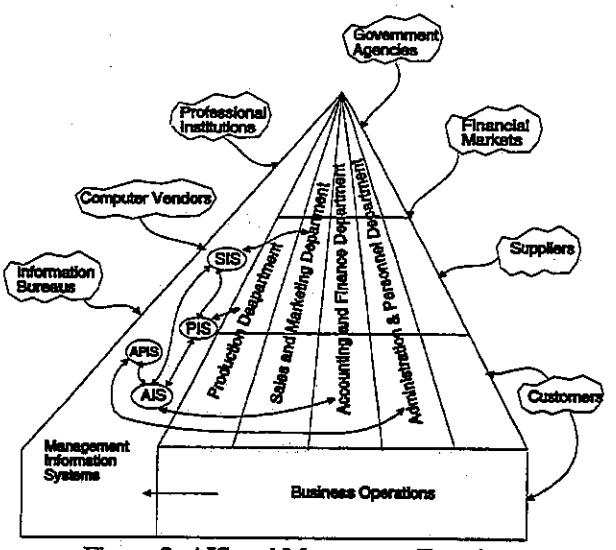

Figure 2: AIS and Managment Functions

2.3 The Associates of an AIS

There are four kinds of people associated with AIS, namely the owner, actor, developer and user. Since AIS is an important investment of an organisation, its ownership would normally belong to the organisation itself. For the owner, the expected benefit from AIS should be in line with the corporate strategies. The accounting staff can be regarded as the actors of AIS. In addition to the responsibility of performing AIS operations, accounting people should play an active role in AIS development and maintenance. The developers of AIS should be a team comprising computing people and accountants. As mentioned in the concept of information, accounting knowledge is the key element of information generation for the changing world. Prototyping [Davis, Bersoff and Comer 1988] is a popular approach to reduce the time lag between the functionalities and information needs. Accounting people may ensure that up-to-date knowledge is in the development process. Users are those who utilise

financial information either inside or outside the organisation. Some internal users may have the authority to access the AIS on an on-line mode while most of the other users would just refer to the reports of AIS.

2.4 Measures of Performance

Although efficiency and effectiveness are two common factors that people use to determine the performance of MIS [Alter 1976, Davis and Olson 1985, Dixon and John 1989], they may be too general and are difficult to be measured objectively. These two measures should be further extended to some explicit meaningful qualitative characteristics . The accounting discipline has a set of well defined qualitative characteristics of accounting information [FASB 1980, IASC 1989, ASRB 1990]. Software quality assurance people also has some attributes [Deutsch and Willis 1988] for ensuring a high degree of quality in software development and maintenance. However, these two types of quality characteristics should be carefully integrated as a unique set of attributes for measuring the performance of AIS. A good set of measures of performance would allow an AIS to be developed and maintained to cope with the ever changing user requirements in the complex business world. This paper proposes thirteen qualitative characteristics of AIS which are shown in Table 1.

Table 1: Qualitative Characteristics of AIS.

Quality Needs	Qualitative Characteristics	Concerned Associates
Performance	Relevance	Accountants Users
	Reliability	Accountants Users
	Materiality	Accountants Users
	Comparability	Accountants Users
	Efficiency	Accountants Users
	Timeliness	Accountants Users
Functional	Integrity	Accountants Owners
	Survivability	Accountants Owners
	Usability	Accountants Users
	Interoperability	Accountants Users
Change	Maintainability	Developers
	Expandability	Developers Owner
Management	Manageability	Owner

3 Comparing the Conceptual and Conventional Models

There are a number of differences between the proposed conceptual framwork and the conventional AIS. A thorough discussion on the differences will provide us with fruitful ideas to improve our environment so that the implementation of the conceptual framework will become practical.

3.1 Systems Connectivities and Boundaries

The main function of most computerised AISs is to transform business transactions into financial reports. Most AISs include a general ledger, accounts payable, accounts receivable, inventory, asset management and payroll. In some newly developed AISs, data from clients' receivables and payables can automatically pass the system through a communication network. With the adequate use of high technologies, AIS can significantly improve the data collection processes and render support to some management functions.

Although accounting is highly related to all business functions of an organisation, the conventional AIS is often confined to the processing of financial accounting information. Most computerised AISs do not provide sophisticated support to management accounting which involves many quantitative models for different kinds of business functions in an organisation. In the conceptual model, the inter-relationships between accounting and other business functions have been highlighted. AIS which is based on the new model is expected to generate information to cover the needs of different levels of management. Interoperability, usability and expendability are the measures of performance to ensure that the connectivities between AIS and other business systems are adequately maintained. The improved situation will encourage the better use of sophisticated management accounting models for achieving optimal decisions for different kinds of management problems. As a result, the effect of integrating the computing and accounting technologies can truly emerge.

3.2 The Role of Accountants

Conventionally, accountants are considered as the users of AIS. No matter who initiates the computerisation of AIS, accountants' requirements are interpreted and transformed into a set of systems specification by computer systems analysts. Since the developers and the users are two different group of people, the knowledge gap between them is the major obstruction for successful AIS development and maintenance. Denying responsibilities for problems becomes the conflicts that cause further problems to AIS.

In addition, staff of other management functions have no direct role in the conventional AIS because these people normally gain access to accounting information

through accountants. The data ownership seems to belong to accounting staff, and this perception would reduce the incentive to use accounting information.

According to the Bedford Report issued by the American Accounting Association (AAA) in 1986, the public expect professional accountants to have a general manager's perspective and to understand national goals in addition to qualifying as a technical expert. The more capable accounting executives need to know how to design, diagnose and monitor systems for planning and controlling operations. The conceptual AIS model characterises the accountants' primary role as actors who ensure the satisfactory development and management of AIS. In order to achieve this active role, accountants should be fully aware of the movement of information technologies and functions of accounting information in an organisation. They should act as negotiators between computing people and all accounting information users, so that the design of AIS may closely follow the requirements of various users. Moreover, accountants should also act as packagers of AIS solutions with high quality condition for all relevant parties.

In the conceptual AIS environment, accounting information users include staff of different business functions. With the better definitions of the associates, the data ownership would not be confined only to accountants , so that information would be used more efficiently and effectively. Better information usage would lead to better co-operation between accountants and other management staff of different kinds of business function. As a result, the AIS environment would provide a good condition for employing sophisticated management accounting models for tackling different kinds of management problems of an organisation.

3.3 Measure of Performance

In reviewing the performance of information systems, efficiency and effectiveness are the two main measures that people always try to observe. Initially , AIS was expected to provide an efficient way to process all accounting data and generate accurate financial reports. Based on this expectation, the benefit of using an AIS were primarily of the cost-saving type. This perspective is the traditional computer application view and is still common in current accounting information systems. This also explains why simple "off the shelf" software is still accepted by many organisations.

The other perspective of information system design looks at the organisation as an information processing system. The focus of this perspective is to find an effective information system for the whole or part of the organisation to which the information is to give service. Effectiveness implies that an AIS should provide different users with adequate information for achieving optimal business decision. No matter which types of accounting software is employed, it should be able to integrate with other business functions of the organisation. Moreover, an ideal AIS should be adaptive to the changes in information needs.

However, both efficiency and effectiveness are measures that contain many subjective elements and are too broad to be considered. In order to provide management with a set of precise measures of AIS performance, this paper selectively integrates the qualitative attributes from accounting standards and software qualitative standards. The measures of performance of the conceptual model show the unique requirements of AIS. In order to highlight the importance of accounting information, effectiveness is represented by relevance, reliability, materiality and comparability. While efficiency is used to determine the economic justification, timeliness represents the rapidity of information supply. The functional and management attributes ensure the satisfactory operations. Maintainability and expendability are two attributes to measure the ability for coping with the ever changing situation. The thirteen measures of performance is a set of indicators to help the major associates to explore the strengths and weaknesses of their AIS. They provide the organisation with correct direction for improving the AIS on an on going basis.

4 Possible Actions for Achieving the Conceptual Model

In the light of the comparison between the conventional and conceptual models of AIS, there are a large number of possible actions that we need to carry out for achieving the desired changes. The changes require both long and short term efforts from accountants, computing professionals, professional institutions and universities. Among many possible changes, education, professional standards and information architecture can be considered as the most important aspects for the future development of AIS.

4.1 Education Aspect

In order to allow accountants to play the roles of negotiators and packagers in AIS, our society should possess an adequate accounting education system. The emphasis of computer literacy is certainly not new in accounting education. In a survey concerning the importance and usefulness of skill and knowledge areas for professional accountants [Estes 1979], computing related knowledge was one of a few areas that was expected to increase substantially in importance in the coming ten years. The design and use of information systems have been repeatedly mentioned as essential components of the general professional accounting education [Bedford Report 1986, Borthick and Scheiner 1988, Kent and Linneger 1988, Novin and Pearson 1989].

However, merely adding conventional computing contents to an accounting curriculum is not an optimal way to prepare accounting graduates to implement the requirements of the conceptual AIS model. Recently, the effort of promoting AIS as a new discipline in management education has been initiated in U.S.A. [Cappelletto 1992]. For example, the School of Accounting and Information Systems of Brigham Young University offers an extremely fore-front accounting degree which intends to teach student to understand the relationship between accounting and computing. In this programme, accounting is seen as an information system that provides information from a database environment to meet the needs of various users. Further, at the University of Tennessee, Knoxville, accounting students are preparing themselves for careers in which information technology is a crucial resource.The objective of these programmes appears to be consistent with the concepts discussed in this paper. However, the accounting education of this kind has not been found common in other universities around the world.

The neglected or slow development of technological accounting programmes may be due to the lack of initiative on the part of accounting academics and professional bodies to highlight AIS as one of the unique professional services. At present, university accounting programmes are designed with due consideration given to the accreditation policies of the professional bodies, so that graduates may after having practical training acquire a professional status. However, the conventional career path emphasises substantially on financial accounting, management accounting, taxation and auditing. Any additional effort of introducing information technologies in an accounting degree course may affect the normal teaching of an accredited curriculum. Therefore, a major programme reorientation requires the support of the accounting profession. In order to develop a technology oriented accounting programme, the accounting profession can consider recognising AIS as a separate stream of specialisation in the accounting industry. Thereby AIS specialists can be fully accredited as professional accountants. With this innovative movement in accounting education, the accounting industry can evolve to meet the challenge beyond the year 2000.

4.2 Professional Standards

Although various regulatory bodies and professional organisations have formulated accounting standards which are authoritative rules to be used in financial accounting or management accounting, there is no specific standard on AIS. Financial accounting standards are developed in relation to what we consider to be the key objectives of financial statements. Computers have been given attention and computer auditing standards have been issued, such as Statement on Auditing Standards No. 48 in the United States, International Auditing Practices IAG 15, 16 and 20, and Australian Statement of Auditing Practice AUP 4, 4.1 and 4.2. However, these auditing standards do not provide a guidance to the development and management of AIS. The document issued by IFAC known as Management Accounting Practices, Study No. 1 "Control of Computer Applications" provides very limited support for guiding the development and management of AIS to a high quality level. Since there is a strong tendancy that AIS will become a significant, if not independent, discipline in accounting, AIS standards should be sought. The development of AIS standards can be regarded as a medium term activity to ensure positive improvement on the future AIS. AIS standards should be developed with the consideration of quality software development standards [Doring and Simms 1992] as the software is the major part of AIS and the management issues of information systems [Niederman et al. 1991]. The measures of performance proposed in this paper can be regarded as a starting point for the development of AIS standards.

4.3 Accounting Information Architecture

The information architecture of AIS is based on the accounting methods and data organisations employed by companies. Recently, Bannister [1991] categorised accounting information processing methods into two different types, namely the "Anglo-Saxon" and "Continental" approaches which are depicted in Figure 3. With the Anglo-Saxon influences, accounting transactions are entered into day books and subsequently posted into seperate books of account like general ledger, accounts recievable, accounts payable. Accountants are free to develop and structure any chart of accounts that a particular organisation wishes to meet its requirements. This approach decentralises the information processing of different accounting functions. In order to achieve a high degree of integration of all accounting functions, the AIS requires support from good interfaces. In contrast, the Continental approach is based on an integrated database structure that facilitates more flexible use of accounting information in an organisation.

Both centralised and decentralised approaches have their own advantages and disadvantages. With adequate support from information technologies, most undesirable features of information architecture can be minimised. However, all existing approaches have evolved from the concept that accounting data include mainly time and data values as the major elements of business transactions. Normally transaction time is the only time stamp that data contain. Since the database models employed by all existing AISs are snapshot database [Snodgrass 1987], the details of valid times and recording times are seldom explicitly included in snapshot

databases. In short, snapshot databases keep the latest states of information only. When committing changes, past states of information are discarded and forgotten completely. It is not possible to retrieve the history of information changes. If such history is required, it has to be handled by the applications in an ad-hoc manner. Therefore, existing accounting database models do not provide complete time information for auditing and management purposes. Moreover, the transaction time of accounting data recorded in existng AIS databases provide users only information of the past and at most to the present time. There is no evidence that AIS data can explicitly imply the validaty and the behaviour of change in the future. The value of accounting data relates only to the physical contents of data. Merely looking at the AIS, the processing methods and the possible changes of accounting data would not be known.

In brief, the concept of knowledge of data is not incoporated in the information architectures. As a result, existing AIS could not reflect the dynamic nature of business situations. Knowledge can be regarded as the force of change of data which ensures the predictability (a major consideration of relevance) of accounting information in organisations.Therefore, knowledge of data should be included as a major element of the accounting information architecture. The knowledge concept discussed in this paper is consistent with the force accounts introduced by Ijiri [1982, 1986] who believes the first step in developing a new framework is to classify income changes and attribute them to underlying forces. From the information technology point of view, there are many techniques, such as Object-Oriented database [Deux 1991, Lamb 1991], Semantic Network database [Su 1983, Hull and King 1987], and Temporal databases [Snodgrass, 1987, Yau and Chat 1991] that we can use to model the meta knowledge of data and the process of data change. The development of a new accounting information architecture is a long term research effort that require extensive support from people of relevant disciplines.

5 Conclusion

An overview of the current state of AIS suggests that there are problems arising from the necessary "marriage" of the accounting and computer disciplines. In the face of the conflicting approach and the lack of understanding between the two parties, rationality and optimisation lie not in seeking final answers, but rather in compromise - essentially a short term solution. In order to strengthen the future development of AIS, a coherent conceptual core has to be formulated as a fusion of the interrelated accounting and computing objectives and concepts. The following is a summary of the important issues of AIS that must be addressed in this decade for meeting needs for the year 2000.

The need to develop a standard set of measures for management to ascertain the impact of information-technology investment on the accounting system can be seen in a recent survey on the Information Systems Management (ISM) issues [Niederman, Brancheau, Wetherbe, 1991]. The concern for the measurement of IS effectiveness and productivity has steadily declined in importance since the SIM surveys were initiated in 1980. It has fallen from the top 10 in the 1990 surveys. This surprising result may be due to the difficulties of establishing objective measures of performance, and the effective measures of information systems need to be linked to business functions.

Following from the fusion phenomenon it is necessary to restructure and reorient the accounting education with substantially greater emphasis on computer education to enable students to meet future challenges. The long term goal is to enhance AIS professional effectiveness by moving towards the creation of schools of accounting and information systems. In alignment with this development, the accounting profession can lend its support by recognising AIS as a unique specialisation of the profession. In the long run the development of a new accounting information architecture is required to extend the dimension of AIS.

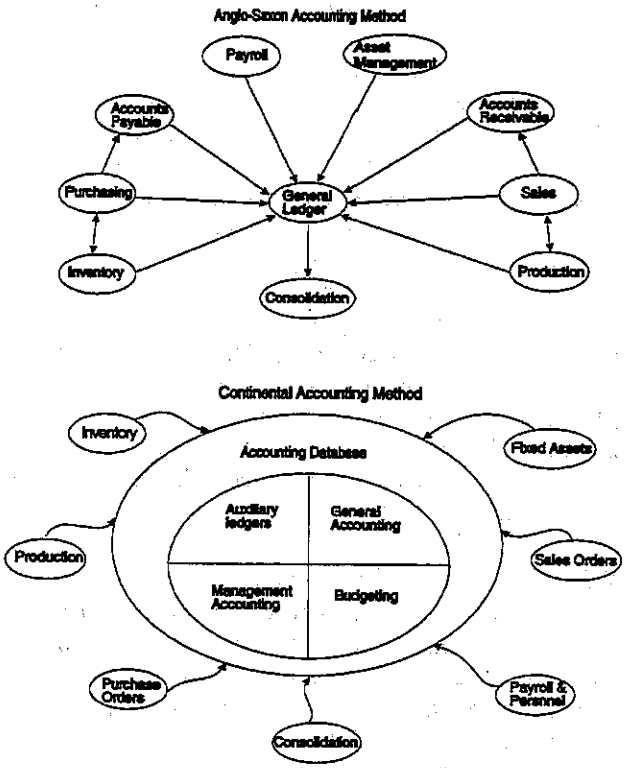

Figure 3: Two Accounting Models

Reference

Accounting Standards Review Board, (1990), Statements of Accounting Concepts No. 3, "Qualitative Characteristics of Financial Information".

Alter S. L., (1976), "How effective Managers Use Information Systems", *Harvard Business Review*, Nov.-Dec. 1976, pp. 97-104.

American Accounting Association Committee on the Future Structure, Content, and Scope of Accounting Education, (1986), "Future Accounting Education: Preparing for the Expanding Profession", *Issues in Accounting Education*, Spring, pp. 168-193.

Bannister, G.A., (1991), "Accounting Systems and Software in France", *Management Accounting*, September, pp. 49-51.

Batty, J., (1970), "*Standard Costing*", MacDonald and Evans Ltd., London.

Borthick, A.F. and Scheiner, J.H., (1988), "Computer Technology in Accounting: Preparation for a Career", *Survey of Business*, Vol. 24, Fall, pp. 6-9.

Cappelletto, G., (1992), "Report on Innovations in Accounting Curricula Tour (USA) September 30 to October 7 1992", the Institute of Chartered Accountants in Australia.

Davis, A.M., Bersoff, E.H. and Comer, E.R. (1988), "A Strategy for Comparing Alternative Software Development Life Cycle Models", *IEEE Trans on Software Engineering*, Vol. 14, No. 10, Oct., pp. 1453-1461.

Davis, G. B. and Olson, M.H., (1985), *Management Information Systems: Conceptual Foundations, Structure, and Development*, McGraw Hill.

Deutsch M.S. and Willis R.R., (1988), *Software Quality Engineering: A Total Technical and Management Approach*, Prantice Hall.

Deux, O., et al, (1991), "The O2 System", *CACM*, Vol. 34, No. 10, pp. 35-48.

Dixon, P.J. and John, D.A. (1989), "Technology Issues Facing Corporate Management in 1990s", *MIS Quarterly*, Vol. 13, No. 3, September, pp. 247-255.

Dorling, A. and Simms, P., (1992), "The Need and Requirements for a Software Process Assessment Standard", *Study Report ISO/IECJTC1/SC7 N944R*, Issue 2, June 1992.

Estes, R., (1979), "The Profession's Changing Horizons: A Survey of Practitioners on the Present and Future Importance of Selected Knowledge and Skills", *International Journal of Accounting, Education and Research*, Spring, pp. 47-70.

Financial Accounting Standards Board, (1980), Statements of Financial Accounting Concepts No. 2, " Qualitative Characteristics of Accounting Information".

Horngren, C.T., (1986), "Cost and Management Accounting: Yesterday and Today", in Bromwich, M. and Hopwood, A.G., (ed), *Research and Current Issues in Management Accounting*, Pitman, U.K.

Hull, R. and King, R., (1987), "Semantic Database Modeling: Survey, Applications and Research Issues", *ACM Computing Surveys*, Vol. 19, No. 3, September, pp. 201-260

Ijiri, Y., (1982), Studies in Accounting Research No. 18, "Triple-Entry Bookkeeping and Income Momentum", American Accounting Association.

Ijiri, Y., (1986), "Management and Accounting Information in the Year 2000", *Journal of Accounting and EDP*, Spring, pp. 4-6.

International Accounting Standards Committee, (1989), "Framework for the Preparation and Presentation of Financial Statements".

Johnson, R.A., Kast, F.E. & Rosenzweig, J.E., (1964), "Systems Theory and Management", *Management Science*, Vol. 10, No. 2, pp. 367-384.

Kaplan, R.S., (1984), "The Evolution of Management Accounting", *The Accounting Review*, Vol. LIX, July, pp. 390-418

Kent, P.F. & Linnegar, G.H., (1988), "Integrating Computers into Accounting Education: A Survey of Australian Universities and Colleges", *Accounting and Finance*, November, pp. 81-91.

Lamb, C., et al, (1991), "The Object Store Database System", *Communication of the ACM*, Vol. 34, No. 10, pp. 51-63.

Niederman, F., Brancheau J.C. & Wetherbe, J.C., (1991), "Information Systems Management Issues for the 1990s", *MIS Quarterly*, December, pp. 475-495.

Novin, A.M. and Pearson, M.A., (1989), "Non Accounting Knowledge Qualifications for Entry Level Public Accountants", *The Ohio CPA Journal*, Vol. 48, Winter, pp. 12-17.

Pellman, T.G., (1991), "Accounting & Computers: The Perfect Union", *The National Public Accountant*, May, pp. 16-20.

Snodgrass, R., (1987), "The Temporal Query Language T Quel", *ACM Transaction on Database Systems*, Vol. 12, No. 2, June, pp. 247-298.

Su, S., (1983), "SAM: A Semantic Association Model for Corporate and Scientific Statistical Databases", *Information Sciences*, Vol. 29, pp. 151-199.

Taylor, R.E., (1956), "Luca Pacioli", in A.C. Littleton and B.S. Yamey, *Studies in ths History of Accounting*, Homewood, Illinois: Richard D. Irwin.

Yau, C. & Chat, G., (1991), "TemSQL: A Language Interface to a Temporal Relational Model", *Journal of Information Science and Technology*, October, pp. 44-60.